(3) $E \to E+E \mid T$
$T \to T \times T \mid (E) \mid a$

$S_0 \to E$
$E \to E+E$
$E \to T$ (remove this)
$T \to T \times T$
$T \to (E)$
$T \to a$

$\Rightarrow$

$S_0 \to E$
$E \to E+E \mid T \times T \mid (E) \mid a$
$T \to T \times T \mid (E) \mid a$

$\downarrow$

$S_0 \to E+E \mid T \times T \mid (E) \mid a$
$E \to E+E \mid T \times T \mid (E) \mid a$
$T \to T \times T \mid (E) \mid a$

(4) No. Assuming $p = 10$:

$(^{10} a)^{10}$ is in the language.

$w = xyz$
$xy = (^{10}$
$z = a)^{10}$

If we pump y, then we get the language:

$(^{10+n} a)^{10}$

which is not in the language.

$U_1 \to E U_2$
$U_2 \to U_3 E$
$U_3 \to +$
$U_4 \to T U_5$
$U_5 \to U_6 T$
$U_6 \to \times$
$U_7 \to U_8 U_9$
$U_8 \to ($
$U_9 \to E U_{10}$
$U_{10} \to)$
$E \to U_3 E \mid T U_5 \mid U_8 U_9 \mid a$
$S \to U_3 E \mid T U_5 \mid U_8 U_9 \mid a$
$T \to T U_5 \mid U_8 U_9 \mid a$

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5) $S_0 \rightarrow S$
$S \rightarrow EF$
a) $E \rightarrow aEb \mid \epsilon$
$F \rightarrow cF \mid \epsilon$

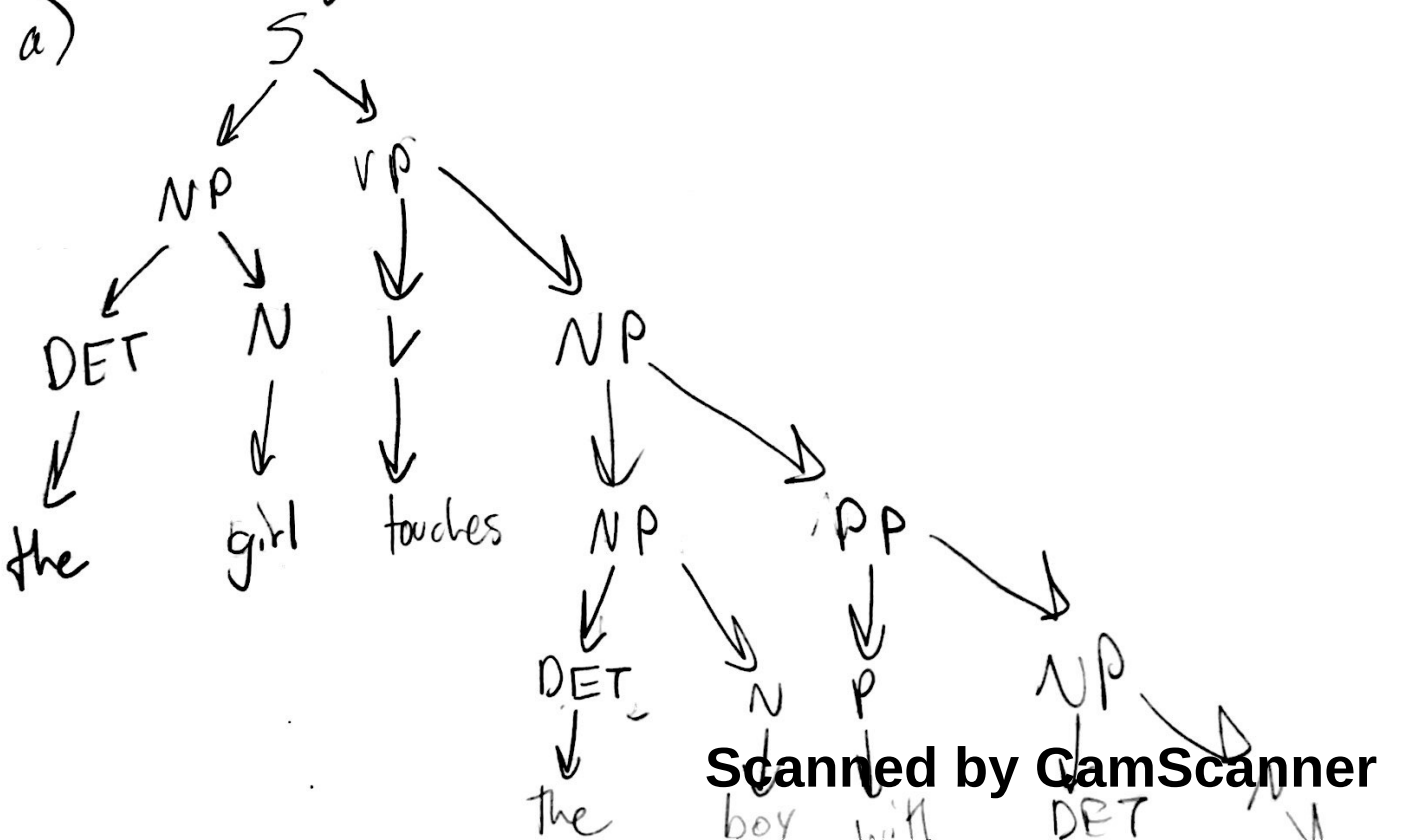
↑
CFG for $a^i b^i c^j$

$a^i b^i c^j$ and $a^i b^j c^j$ are both CFG. If CFG closed under intersection, then $a^i b^i c^i$ must also be CFG. B/c it is not CFG cannot be closed under intersection.

b) Assuming pumping length p:

$a^p b^p c^p$ is in language. No matter how you divide the string into uvxyz, b/c $|vxy| \leq p$, vxy can only contain two of the characters. Therefore when it is pumped, it will no longer be in the language.

6) a)



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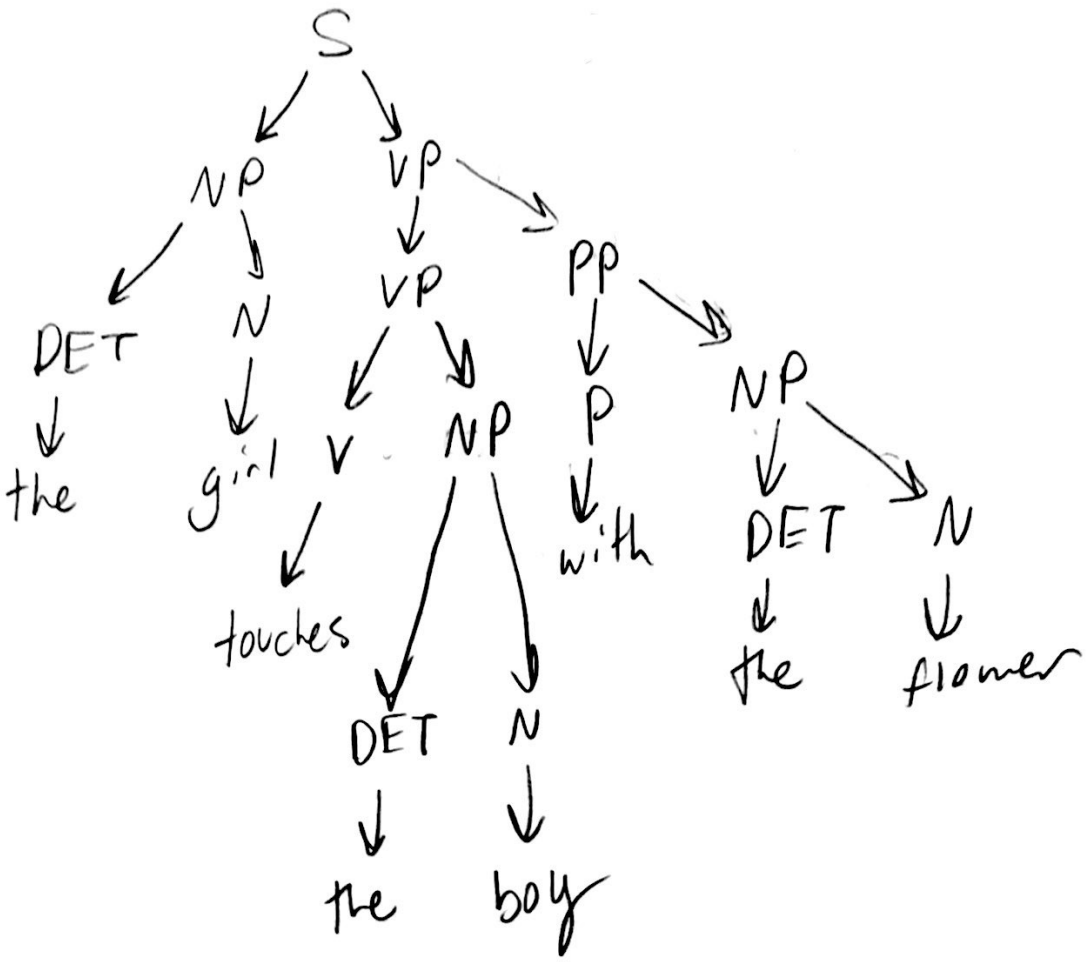
b)



The boy either has a flower or is touched by one.

c) the girl sees the boy with binoculars

d)
N → ADJ N
ADJ → tall / purple
N → boy / girl / flower / purple

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